BASIC (BIOLOGICAL AGRICULTURE SYSTEMS IN COTTON): A COTTON PEST MANAGEMENT INNOVATORS GROUP IN THE NORTHERN SAN JOAQUIN VALLEY

California Environmental Protection Agency
Department of Pesticide Regulation
Contract No. 95-0259

Final Second Year Report
March 31, 1998

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Summary of Progress to Date

The BASIC Pest Management Innovators Work Group in cotton was formed in 1995 to test and disseminate innovative ideas in cotton pesticide use reduction. The work group does this through an organized outreach program made up of cotton farmers, pest control advisors, agronomists, and U.C. Farm advisors and researchers. The Work Group documents the efficacy and suitability of BASIC insect and weed management options in the cotton production system by testing and monitoring techniques that significantly reduce or eliminate agrochemical use. Techniques include biologically based management of arthropod pests and use of non chemical weed control methods.

In 1997 the project completed a successful second season, in which we recruited new growers; selected and enrolled individual BASIC fields in a statistical sample; established and executed the BASIC monitoring protocol for 1997 (plant mapping, soil and petiole nutrient analyses, and monitoring key arthropod populations); initiated year-end yield, fiber quality, water use, and economic analyses; evaluated and discussed these preliminary data with BASIC

growers; and conducted public outreach through a series of breakfast meetings and on-farm field days.

We are currently completing the second season (1997) final grower interview process, from which we will obtain gin record-based yield and lint quality data, and information for economic, energy use, and water use analyses. We have nearly completed analysis of this data from 1996, and present it in this report as well.

Over a three-year period, the BASIC Pest Management Innovators Work Group is promoting new production strategies while assessing the agronomic and economic potential for biologically based pest management in cotton in the northern San Joaquin Valley. This knowledge is crucial for reducing agrochemical use and environmental impacts in one of California's most pesticide-dependent crops. The BASIC Pest Management Innovators Work Group will serve as a model for organizing similar cotton work groups in the southern San Joaquin Valley cotton regions.

Results and Discussion

Objective 1. *With the collaborative support of the US-EPA, form the BASIC Pest Management Innovators Work Group of cotton growers in the northern San Joaquin Valley (Merced, Madera, and northern Fresno counties). In 1997 the goal is to retain 1996 growers and to expand the program to additional growers. Ten to twenty innovative growers will enroll production units in a supervised pest management program of monitoring and biologically based pest management alternatives, including beneficial insect release, trap and insectary plant cropping and mechanical weed control.*

We recruited 13 farmers (4 new, 9 retained from 1996) to participate in the program, with a total of 12 enrolled fields (9 growers) and 11 check fields (4 growers). Seed variety, planting date, and willingness to share information on production practices were verified. We continued the pest management program initiated in 1996, with one additional component. The 1997 program consisted of a total of five components: (1) reduction or elimination of early-season insecticide and acaricide spraying; (2) extensive monitoring and updates on production fields; (3) lacewing releases for pest control; (4) location adjacent to at least one alfalfa field; and (5) (the added component) early planting date.

Objective 2. *Monitor enrolled fields as on farm demonstrations compared with local conventional input fields in multi-year evaluations of innovative whole-system management strategies. We will compare potential yield-limiting factors in these two systems associated with: (1) plant development; (2) soil characteristics; (3) foliar nutrient availability; (4) weed density; and (5) population dynamics of key arthropod pests and their natural enemies.*

We monitored plant development from early June until defoliation, in September, measuring plant height, number of nodes, number of fruiting branches, first position retention on the bottom five and top five fruiting branches, and nodes above white flower (an indicator of the amount of time to cutout). Immediately prior to harvest we took one final plant sample, for which we constructed complete maps of fully developed plants, measuring all the in-season development parameters as well as total numbers of open bolls and green bolls at each position (first, second, and third-plus). Arthropods were monitored from June to September as well, both with leaf samples (for thrips, mites, and aphids, as well as eggs and immature stages of common natural enemies) and weekly with sweep samples (for lygus bugs and generalist natural

enemies). At the time of the final plant sample, we also estimated per-acre cotton yields for each field by hand-harvesting four one-thousandth-acre pick plots per treatment replicate (chosen randomly within each replicate quadrant), and using appropriate conversion factors to determine equivalent machine-harvested and then ginned cotton yields (machine harvest = hand harvest * 0.75; ginned cotton weight = seed cotton wt. * lint turnout; turnout either (a) assumed to be the same as turnout of cotton grown by the same farmer for the prior year, or if that is not available, (b) assumed to be 32.5% for organic and 35% for conventional fields). We are now verifying these estimates with gin records, when available. See Appendix A for a summary of 1997 results to date.

Soil samples were taken on each enrolled and check field prior to planting, and foliar nutrient tests were done four times during the production season (first square, first bloom, peak bloom, and first open boll stages, corresponding to late June, mid-July, mid-August, and mid-September, respectively). Tests from these samples have yet to be analyzed. In a prior study comparing organic and conventional cotton production, we found no consistent soil or foliar nutrient differences between the two systems.

Objective 3. *Demonstrate key techniques necessary to overcome yield-limiting factors via auxiliary, replicated commercial sized plots, in on-farm experiments emphasizing: (1) lygus bug control with alfalfa or non-crop vegetation and alternative watering methods; (2) release and tracking of beneficial insects (green lacewings) for biological pest control; and (3) alternative weed control practices with new cultivators, mowers, and flamers.*

During the 1997 production year, we stimulated and assessed grower interest in these alternative techniques. Competitive grant proposals submitted in 1997 for conducting research with U.C. researchers Dr. Daniel Gonzalez (lygus control methods), Dr. Tim Prather (alternative weed control practices), and Dr. Bill Weir (lygus control methods) were not funded by extra-mural sources. However, we anticipate funding of an additional proposal (USDA-SARE) submitted at the end of the 1997 calendar year. With pre-existing 1997 funds, we conducted two in season flame weeding trials. We were fortunate to have the expertise of Dr. Tim Prather (UCCE - Kearny Agricultural Center) in designing and executing these experiments. The first

experiment examined the efficacy of flame weeding on weed control in mid-season cotton (~ 20 in. high), and the second looked at the impacts of flame weeding on pest and beneficial insect populations. See Appendix A for a summary of the results of these experiments.

Objective 4. *Document the three year economic and energetic costs of the BASIC Pest Management Systems.*

By the end of 1996, we had completed compiling data on general economics and energy use of cotton production in California. Using this data and information from interviews with participating growers, we estimated 1996 operational costs of production for both BASIC and conventional growers in our study (Appendix A). We limit our economic analysis to operational (or farmgate) costs, not including costs which (a) may be incidentally different between individual growers (e.g. cash and non-cash overheads); or (b) are impossible to accurately estimate (e.g. risk associated with alternative production methods; additional marketing costs for organic cotton). The 1996 energetic analysis has not yet been completed. Grower interviews for the 1997 season are anticipated for April 1998, due to poor planting weather.

Objective 5. *With the collaboration of the US-EPA and the Sustainable Cotton Project, disseminate these monitoring and experimental results to the BASIC Work Group in monthly technical meetings during the growing seasons and to the cotton farming community via meetings, farm field days and publications.*

We held five farmer breakfast meetings and two field days in 1997, documentation of which is included in Appendix B. In addition, we sent monthly field updates to growers during the peak production period (July to September), and sent an end-of-season update in January 1998 (Appendix C). In these updates we provided a summary of plant and arthropod population parameters to date in the group as a whole; showed graphs comparing these values in BASIC and check fields; and provided charts detailing the performance of each individual field. All of the information was provided anonymously, with fields identified by a code known only by that particular grower and by BASIC researchers.